Understanding the Components of Quality Improvement Collaboratives: A Systematic Literature Review

ERUM NADEEM,¹ S. SERENE OLIN,¹
LAURA CAMPBELL HILL,²
KIMBERLY EATON HOAGWOOD,¹
and SARAH McCUE HORWITZ¹

¹*New York University*; ²*Columbia University*

Context: In response to national efforts to improve quality of care, policymakers and health care leaders have increasingly turned to quality improvement collaboratives (QICs) as an efficient approach to improving provider practices and patient outcomes through the dissemination of evidence-based practices. This article presents findings from a systematic review of the literature on QICs, focusing on the identification of common components of QICs in health care and exploring, when possible, relations between QIC components and outcomes at the patient or provider level.

Methods: A systematic search of five major health care databases generated 294 unique articles, twenty-four of which met our criteria for inclusion in our final analysis. These articles pertained to either randomized controlled trials or quasi-experimental studies with comparison groups, and they reported the findings from twenty different studies of QICs in health care. We coded the articles to identify the components reported for each collaborative.

Findings: We found fourteen crosscutting components as common ingredients in health care QICs (e.g., in-person learning sessions, phone meetings, data reporting, leadership involvement, and training in QI methods). The collaboratives reported included, on average, six to seven of these components. The most common were in-person learning sessions, plan-do-study-act (PDSA) cycles, multidisciplinary QI teams, and data collection for QI. The outcomes data

Address correspondence to: Erum Nadeem, NYU Child Study Center, Department of Child and Adolescent Psychiatry, One Park Avenue, 7th Floor, New York, NY 10016 (email: Erum.Nadeem@nyumc.org).

from these studies indicate the greatest impact of QICs at the provider level; patient-level findings were less robust.

Conclusions: Reporting on specific components of the collaborative was imprecise across articles, rendering it impossible to identify active QIC ingredients linked to improved care. Although QICs appear to have some promise in improving the process of care, there is great need for further controlled research examining the core components of these collaboratives related to patient- and provider-level outcomes.

Keywords: quality improvement, health services research, organizational innovation, quality assurance, Breakthrough Series.

FOLLOWING THE INSTITUTE OF MEDICINE'S INFLUENTIAL report "Crossing the Quality Chasm," which highlighted significant deficiencies in the quality of health care (IOM 2001), enormous emphasis has been placed on improving health care processes through the implementation of evidence-based practices (EBPs). As states and large organizations respond to calls to improve the quality of care, policymakers and health care leaders seek effective strategies to change provider practices and, ultimately, patient outcomes. Quality improvement collaboratives (QICs) and other multiorganization models used to improve the quality of care and implement evidence-based practices have become very popular. In behavioral health alone, through the National Council for Community Behavioral Healthcare (NCCBH), thirty-five states are now using QICs to change health care provider practices (A. Salerno, personal communication, July 1, 2012). The federal government also is making significant investments in QICs. For example, the Substance Abuse and Mental Health Services Administration (SAMHSA) recently called for applications for State Adolescent Treatment Enhancement and Dissemination grants totaling \$30 million over three years (SAMHSA Bulletin 2012). These grants are intended to help states develop "learning laboratories" focused on shared provider experiences when implementing EBPs to improve outcomes for youth and families. Which features of these collaborative models are most important to predicting patient and provider outcomes are not well understood, however.

Policymakers are beginning to recognize that the minimalist training and consultation models typically used for large-scale rollouts of new quality improvement practices are insufficient and that without

monitoring, feedback, and organizational support, new practices often do not succeed (Bond et al. 2009; Schoenwald and Hoagwood 2001; Schoenwald, Sheidow, and Letourneau 2004). The goal of our article is to update the literature on the QICs' patient- and provider-level outcomes, to characterize how the common QIC components are reported in empirical outcome studies, and to identify, to the extent possible, the relationships between the QICs' components and provider- and patient-level outcomes.

Theoretical Background

QICs in health care emerged after the publication of several papers highlighting the potential of continuous quality improvement (CQI) methods, originally developed for use in industry, to improve care processes in health care (e.g., Berwick 1989, 1996; Laffel and Blumenthal 1989). These approaches, which first gained popularity as a way to address manufacturing deficiencies, are now well integrated into a number of industries and management practices (Deming 1986; Ishikawa 1985; Juran 1951, 1964). CQI methods are based on the notion that ongoing data collection can be used to identify production deficiencies, which can then be targeted for improvement and reassessed (Deming 1986; Ishikawa 1985; Juran 1951, 1964). Inherent in this approach is the assumption that improvement is always possible and continuous and that workers intend to perform well (Berwick 1989; Deming 1986).

The multiorganizational quality improvement efforts that are the focus of this article emerged in part from the failures and perceived limitations of single-organization quality improvement efforts in health care. Perhaps the most widely used QIC approach in controlled outcome studies is the Breakthrough Series (BTS) collaborative developed by the Institute for Healthcare Improvement (IHI 2003; Kilo 1998), although there are many variations of this model (e.g., Ayers et al. 2005; Becker, Drake, and Bond 2011; Ebert et al. 2012; Mittman 2004; Øvretveit et al. 2002; Plsek 1997; Solberg 2005; Wilson, Berwick, and Cleary 2004). The BTS is designed as a specific model for achieving rapid, measureable, and sustained improvements, with the intention of weaving QI processes into the everyday work of QIC participants (Baker 1997; Kilo 1998). The BTS's components include formation of a planning group that decides on a target objective and identifies areas for change,

pre-work from participants (e.g., identifying QI team members and roles and planning for necessary supports), in-person learning sessions during which teams learn clinical and QI approaches, and ongoing support (e.g., phone calls, visits, email, brief reports). Between learning sessions, participants engage in plan-do-study-act (PDSA) cycles during which they make small interventions and assess their impact (Kilo 1998).

Controlled studies also have investigated the Vermont Oxford Network's QICs for neonatal intensive care, which use the network's existing data infrastructure as a platform for CQI. This organization has implemented cross-site QICs that incorporate group training in QI methods, site visits, and self-studies (Plsek 1997). The network's QIC forms a local QI group, assesses organizations' care processes and procedures, sets benchmarks through site visits by QIC participants to high-performing sites, finds strategies for improvement, experiments with implementing strategies, and assesses change (Horbar et al. 2001, 2004; Plsek 1997; Rogowski et al. 2001).

Our Study

Given the QICs' promise and popularity, we need reliable evidence that they are effective for implementing innovations and improving the quality of care. While some evidence shows that QICs can change providers' practices (Bundy 2006; Cretin, Shortell, and Keeler 2004; Young et al. 2006), reviews of health care QICs suggest that the positive effects of such models are limited (Mittman 2004; Schouten et al. 2008). In a systematic literature review, Schouten and colleagues (2008) examined the methodological quality and outcomes of nine controlled studies of health care QICs, the majority of which used matched controls or administrative data for comparison. Two studies had positive effects on study outcomes (i.e., infant mortality rates, patient pain prevalence); two studies found no differences; and the rest were mixed, with the positive effects limited to quality indicators or process of care variables, assessed through abstracts of medical records or administrative data (Schouten et al. 2008).

One major obstacle to synthesizing findings across studies of QICs is the variation in QIC models used, the types of outcomes targeted, and the varied detail with which components are described in scientific reports (Mittman 2004; Schouten et al. 2008; Solberg 2005). There also is

little understanding of which components may be linked to positive process of care and patient outcomes (Mittman 2004; Schouten et al. 2008; Solberg 2005). Some evidence suggests that participants value contact with expert faculty, solicitation of staff perspectives, PDSA cycles, learning sessions, and an extranet where information is exchanged (Nembhard 2009). Similarly, Schouten, Grol, and Hulscher (2010) identified four core QIC processes: sufficient expert team support, effective multidisciplinary teamwork, the use of a model for improvement, and helpful collaborative processes. In particular, engagement in interorganizational learning and deliberate learning activities (e.g., PDSA, solicitation of staff ideas, staff education) appear to be important to improving performance indicators among QIC participants (Nembhard 2012; Nembhard and Tucker 2011). A synthesized examination of how the core components of QICs are described in the outcome literature, as well as an exploration of the links between specific components and positive outcomes across QIC outcome studies, could help the development of more effective QICs.

Regardless of the QIC model they used, the many approaches clearly showed similarities and differences, although each approach emphasized different components. In their initial systematic review, Schouten and colleagues (2008) concluded that QICs had little positive impact and a great need for better-designed studies. Our study updates their review with new controlled outcome studies. In addition, our review builds on recent research suggesting that certain QIC processes may be particularly important to improving performance (Nembhard 2009, 2012; Nembhard and Tucker 2011; Schouten, Grol, and Hulscher 2010). Specifically, the goals of this systematic review are to determine whether additional conclusions can be drawn about the effectiveness of QICs based on the published information and to characterize how core QIC structures and processes are described in the QIC outcome literature. We also looked for any possible relationships between these QIC components and provider- and patient-level outcomes.

Methods

We found the core components described in the existing outcome studies by reviewing the outcome studies with the comparison groups in Schouten and colleagues' 2008 paper, as well as with additional studies

with comparison groups published more recently. Using Schouten and colleagues' methodology, we searched five major databases: All EBM Reviews (Cochrane DSR, ACP Journal Club, DARE, CCTR, CMR, HTA, and NHSEED), CINAHL (Cumulative Index to Nursing and Allied Health Literature), Embase, OvidMEDLINE, and PsycInfo. Because Schouten and colleagues reviewed articles published from January 1995 to June 2006, we concentrated on articles published from June 2006 to April 2012 (or more generally, 2006 to 2012 for databases that do not allow searches with month-specific date ranges) for any relevant articles not in the earlier review. We replicated Schouten and colleagues' search process using the same two primary sets of search terms, the non-MeSH keywords "quality improvement collaborative" or "breakthrough and (series or project)," in combination with a set of MeSH terms ("organizational-innovation" or "models-organizational" or "cooperative-behavior"; "program-evaluation" or "total-quality-management" or "quality-assurance-health-care"; "health-services-research" or "regional-medical-programs"). Because their term "Organi?ation* near (collabor* or participa*)" did not map to any existing MeSH headings, we omitted it from our search.

Our inclusion criteria for this systematic review were that articles had to be peer reviewed, written in English, and either randomized controlled trials or quasi-experimental studies with a comparison group. In order to define QIC components, we searched the theoretical literature (Ayers et al. 2005; Becker et al. 2011; Ebert et al. 2012; Kilo 1998; Mittman 2004; Øvretveit et al. 2002; Plsek 1997) and more recent research on QIC processes (e.g., Nembhard 2009; Schouten, Grol, and Hulscher 2010), and we reviewed the definition used by Schouten and colleagues (2008). We then conducted informational interviews with a subset of QICs purveyors in order to elicit more detail.

Our study defines QICs as organized, structured group learning initiatives in which the organizers took the following steps: (1) convened multidisciplinary teams representing different levels of the organization; (2) focused on improving specific provider practices or patient outcomes; (3) included training from experts in a particular practice and/or the quality improvement methods; (4) provided a model for improvement with measurable targets, data collection, and feedback; (5) used multidisciplinary teams in active improvement processes in which they implemented "small tests of change" or engaged in PDSA activities; and (6) employed structured activities and opportunities for learning and

FIGURE 1. Article selection process.

cross-site communication (e.g., in-person learning sessions, phone calls, email listservs) (Ayers et al. 2005; Becker et al. 2011; Ebert et al. 2012; Kilo 1998; Mittman 2004; Øvretveit et al. 2002; Plsek 1997; Solberg 2005; Wilson, Berwick, and Cleary 2004).

Two of us (Laura Hill and Erum Nadeem) reviewed all the abstracts generated by the initial search to select articles that merited a full-text review. We also reviewed each article retrieved to determine whether

it met our final inclusion criteria. In the event of a discrepancy, or if inclusion was unclear, we conferred with Sarah Horwitz, Kimberly Hoagwood, and Serene Olin to make a final determination.

Once we had decided on the articles, we coded each, using a standardized table to summarize the study's details (e.g., topics, study design, setting, sample, QIC components). A primary coder (Laura Hill or Erum Nadeem) was assigned to each article, and a secondary coder reviewed the primary coder's work. Disagreements were resolved by consensus.

Results

Literature Search

Our initial search generated 294 unique articles published between January 2006 and April 2012 (see figure 1). After reviewing these articles' abstracts, we determined that twenty met the criteria for a full-text review. After the full-text review, thirteen met the criteria for final inclusion. These articles were published between 2006 and 2010. Adding these articles to those studied by Schouten and colleagues (2008) produced a total of twenty-four articles covering twenty different studies (five RCTs and fifteen with nonrandomized comparison groups) published from 2001 to 2010 (see table 1). The QICs in these studies covered a range of health and health care topics, many focusing on chronic conditions.

Table 1 summarizes the study type, QIC model, study design, and outcomes for each study included in our review. Table 2 details the QIC components of a given study, and table 3 expands the definitions of the study characteristics and QIC components that were tracked. All the studies document the study design, QI target, the QIC model, study sample, data sources, and outcomes. We identified the QIC features discussed earlier through a review of the theoretical literature categorized into components, QI processes, and organizational involvement. *QIC components* refer to the QIC activities and features comprising the overarching structure of the QIC. The table's *QI processes* section describes how PDSAs and other QI activities were conducted, an important area of analysis because such processes are central to the model. *Organizational involvement* pertains to indicators of how the QIC penetrated different levels of the organization. A QI team typically is a small,

TABLE 1
Study Details, Organized by QIC Model

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
1	Baier et al. 2004	Pain management in nursing homes	• BTS	Q	99 organizations: • 21 experimental • 78 comparison organizations (Comparison used for only one study measure)	N/A	●	●
2	Carlhed et al. 2006 Carlhed et al. 2009	Adherence to treatment guidelines for acute myocardial infarction (AMI)	• BTS	Q°	38 hospitals: • 19 experimental hospitals, 2 subgroups: ▸ 8 high-intensity condition ▸ 8 low-intensity condition • 19 control hospitals	Online data from the Registry of Information and Knowledge about Swedish Heart Intensive Care Admissions (RIKS-HIA) for 6,878 patients	N/A ◐	● N/A

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
3	Howard et al. 2007 ^a	Improved "conversion rates" in organ donation (increased proportion of eligible donors becoming actual donors)	• BTS	Q	220 hospitals: <ul style="list-style-type: none">• 95 experimental hospitals• 125 control hospitals	Data on actual organ donors and the number of eligible (or potential) donors from the Organ Procurement and Transplantation Network (OPTN); data on historical trends in the number of organ donors from the OPTN website	N/A	●

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
4	Margolis et al. 2008	Office systems that promote early childhood development in primary care practices	• BTS	Q	25 practices • 18 experimental practices • 7 comparison practices	Provider surveys, medical records gathered from 20 consecutive patients age 0 to 4 (mean = 69 per month), and parent surveys	N/A	●
5	Schouren et al. 2010b	Cost effectiveness of diabetes management	• BTS	Q	15 sites: • 6 experimental sites • 9 control sites	Project documentation and survey data from 1,861 patients	Examining cost effectiveness; favorable incremental cost-effectiveness ratios compared with usual care	●
6	Benedetti et al. 2004	Diabetes care	• BTS • CCM	Q	1 organization, 9 primary care sites: • 11 participating providers • 9 non-participating providers	Medical record data from 698 patients		●

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
7	Landon et al. 2004	Quality of care in outpatient HIV clinics	• BTS • CCM	Q	Sample drawn from 62 clinics funded by the Ryan White CARE Act in an IHI collaborative 69 clinics: • 44 experimental • 25 matched control	Medical record data from 9,986 patients	⊘	⊘
	McInnes et al. 2007			Q	Sample drawn from 62 clinics funded by the Ryan White CARE Act in an IHI collaborative 87 clinics: • 52 experimental • 35 matched control	Survey data from 1,336 clinicians and administrators	N/A	◐

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
8	Asch et al. 2005	Chronic heart failure (CHF)	• BTS • CCM	Q	Sample drawn from 14 organizations participating in a collaborative 8 organizations: • 4 experimental • 4 matched control	Medical record data from 489 patients	N/A
	Baker et al. 2005	Heart failure (HF)		Q	Sample drawn from 14 organizations participating in a collaborative 14 sites: • 7 experimental • 7 matched control	Interview data from 781 patients
9	Homer et al. 2005	Childhood asthma care	• BTS • CCM	R	43 primary care practices: • 22 experimental • 21 control	Interview data from 631 parents of children with asthma		N/A
10	Mangione-Smith et al. 2005	Pediatric asthma care	• BTS • CCM	Q	13 sites: • 9 experimental • 4 matched control from the same organizations	N/A

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
11	Schonlau et al. 2005	Adult asthma care	<div>Q<ul style="list-style-type: none">• BTS• CCM</div>		<div>9 organizations:<ul style="list-style-type: none">• 6 experimental• 3 matched control</div>	N/A		
12	Chin et al. 2007	Diabetes care in community health centers	<div>R°<ul style="list-style-type: none">• BTS• CCM</div>		<div>34 organizations originally enrolled, 32 organizations at completion:<ul style="list-style-type: none">• 15 to 16 high-intensity condition• 16 standard intensity condition</div>	Medical record data from 6,993 patients	N/A	

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
13	Landon et al. 2007	Management of chronic disease at community health centers	• BTS • CCM	Q	64 community health centers: • 44 experimental centers • 20 control centers	Medical record data from 9,658 patients	N/A
14	Polacek et al. 2009	Improved clinical decision support and family risk management for overweight children	• BTS • CCM	Q	22 sites: • 12 experimental sites • 10 control sites	Medical record data from 600 patients, parent survey data from 346 to 386 parents, a second survey from 539 parents, and provider survey data from 14 to 17 providers	N/A
15	Barceló et al. 2010	Diabetes care and outcomes in Mexico	• BTS • CCM	R	10 public health centers:	Medical record data from 307 patients

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
16	Schouten et al. 2010a	Chronic care management of type 2 diabetes in an integrated care setting	● BTS ● CCM	Q	● 5 experimental centers	Medical record data from 1,861 patients, survey data from 1,368 to 1,630 patients, and provider surveys from 35 physicians		
					● 5 control centers			
17	Colón-Emeric et al. 2006	Fall reduction in nursing homes	● Other Model	Q	15 regions (37 general practices, 13 outpatient clinics)	Facility-reported and state-mandated data from 832 patients		
					● 6 experimental regions ● 9 control regions 389 nursing facilities: ● 36 experimental ● 353 comparison facilities			

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
18	Kritchevsky et al. 2008	Antimicrobial prophylaxis in surgical patients (i.e., antibiotic prescription before surgery)	• Other Model	R	44 acute care hospitals: • 22 experimental • 22 control	Medical record data from 4,447 patients at baseline; 4,463 patients at remeasurement	N/A	●
19	Horbar et al. 2001	Neonatal intensive care	• VON	Q	Sample drawn from providers in the Vermont Oxford Network 76 NICUs: • 10 experimental, 2 subgroups: ▸ 6 NICUs focused on infection ▸ 4 NICUs focused on chronic lung disease • 66 comparison NICUs	N/A	●	N/A

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
Q								
Rogowski et al. 2001	Neonatal intensive care				<i>Sample drawn from providers in the Vermont Oxford Network</i> <ul style="list-style-type: none">19 NICUs:<ul style="list-style-type: none">10 experimental, 2 subgroups:<ul style="list-style-type: none">6 NICUs focused on infection4 NICUs focused on chronic lung disease9 comparison NICUs	Network data from 6,866 patients	Examining changes in hospital costs; significant cost savings for the experimental group	

Continued

TABLE 1—Continued

Study Number	Article	Target for Improvement	Model (s)	Study Design	Study Sample	Additional Data Sources	Patient Outcomes	Provider Outcomes
20	Horbar et al. 2004	Neonatal intensive care	• VON R	114 NICUs: • 57 experimental • 57 controls	N/A	⊘		●

Note: ^aExtra details on study components are provided in Shafer et al. 2008.

Key

Q° Quasi-experimental

Q° Quasi-experimental with active condition

R° Randomized controlled trial (RCT)

R° Randomized controlled trial (RCT) with active condition

• BTS Breakthrough Series

• CCM Chronic care model

• VON Vermont Oxford Network

• Other Model Model not clearly aligned with established models

⊘ No effect

◐ Some positive effects

● Significant positive effects

N/A Not assessed

TABLE 2
QIC Components by Study, Organized by QIC Model

Study Details			QIC Components					QI Processes				Organizational Involvement			
Study Number	Article	Length of Collaborative	Pre-Work: Expert Convened Panel	Pre-Work: Organizations Required to Demonstrate Commitment	In-Person Learning Sessions	PDSAs	Multidisciplinary QI Team		QI Team Calls	Email or Web Support	Sites Collected New Data for QI	Sites Reviewed Data and Used Feedback	External Support with Data Synthesis and Leadership and Involvement /Outreach	Training for "Non-QI Team Staff Members" by the QI Team	
							QI Team	QI Team							
1	Baier et al. 2004	15 months	⊖	⊖	✓	✓	✓	✓	⊖	⊖	✓	✓	✓	⊖	✓
2	Carlhed et al. 2006 Carlhed et al. 2009	6 months	✓	⊖	✓	✓	✓	✓	✓	✓	✓	✓	✓	⊖	⊖
3	Howard et al. 2007 ^a	Phase I: 6 months Phase II: 8 months	✓	⊖	✓	✓	✓	✓	✓	✓	✓	✓	✓	⚡	✓
4	Margolis et al. 2008	12 months	⊖	⊖	✓	⚡	⚡	✓	✓	⊖	✓	⚡	⊖	⊖	⊖
5	Schouten et al. 2010 ^b	12 months	✓	⊖	✓	✓	✓	✓	⚡	⚡	✓	⊖	✓	⊖	⊖
6	Benedetti et al. 2004	12 months	⊖	⊖	✓	✓	✓	✓	⊖	⊖	✓	✓	⊖	⊖	✓
7	Landon et al. 2004 ^b McInnes et al. 2007 ^b	16 months total ^b 18 months total ^b	⊖	⊖	✓	✓	✓	✓	✓	✓	✓	⊖	⚡	⊖	⊖

Continued

TABLE 2—Continued

Study Details			QIC Components					QI Processes				Organizational Involvement			
Study Number	Article	Length of Collaborative	<i>Pre-Work:</i> Convened Expert Panel	<i>Pre-Work:</i> Organizations Required to Demonstrate Commitment	In-Person Learning Sessions	PDSAs	Multidisciplinary QI Team	QI Team Calls	Email or Web Support	Sites Collected New Data for QI	Sites Reviewed and Data Used for Feedback	External Support with Data Synthesis and Feedback	Leadership and Involvement /Outreach by Experts	Training for “Non-QI Team Staff Members” by the QI Team	
8	Asch et al. 2005	12 months	⊖	✓	✓	✓	✓	✓	✓	⊖	⊖	⊖	✓	⊖	⬢
9	Baker et al. 2005	12 months													
	Homer et al. 2005	12 months	⊖	⊖	✓	✓	✓	✓	✓	✓	⬢	✓	⊖	⬢	⊖
10	Mangione-Smith et al. 2005	12 months	⊖	⊖	✓	✓	⬢	⊖	⊖	⬢	⊖	⊖	⊖	⊖	⊖
11	Schonlau et al. 2005	12 months													
	Schonlau et al. 2005	12 months	⊖	⬢	✓	⬢	⬢	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖
12	Chin et al. 2007	12 months	⊖	✓	✓	✓	⬢	✓	✓	✓	✓	✓	✓	⊖	⊖
13	Landon et al. 2007	Unclear	⬢	⬢	✓	✓	⬢	✓	✓	⬢	⊖	⊖	⊖	⊖	⊖
	Polacek et al. 2009	18 months	✓	⊖	✓	✓	✓	✓	✓	✓	✓	✓	✓	⊖	⊖

Continued

TABLE 2—Continued

Study Details		QIC Components					QI Processes			Organizational Involvement				
Study Number	Article	Length of Collaborative	Pre-Work: Convened Expert Panel	Pre-Work: Organizations Required to Demonstrate Commitment	In-Person Learning Sessions	PDSAs	Multidisciplinary QI Team	QI Team Calls	Email or Web Support	Sites Collected New Data for QI	Sites Reviewed Data and Used Feedback	External Support with Data Synthesis and Feedback	Training for "Non-QI Team Staff Members" by Experts	Training for "Non-QI Team Members" by the QI Team
15	Barceló et al. 2010	18 months	⊖	⊖	☑	☑	☑	⊖	⊖	☑	⊖	⊖	☑	☑
16	Schouten et al. 2010a	12 months	☑	☑	☑	☑	☑	☑	☑	☑	⊖	⊖	⊖	☑
17	Colón-Emeric et al. 2006	9 months	⊖	⊖	☑	⊖	☑	☑	☑	☑	⊖	⊖	⊖	⊖
18	Kritchevsky et al. 2008	9 months	⊖	⊖	☑	⊖	⊖	☑	☑	☑	⊖	☑	☑	☑
19	Horbar et al. 2001	3 years	⊖	⊖	☑	☑	☑	☑	⊖	☑	☑	⊖	⊖	⊖
20	Rogowski et al. 2001	2 years (3 years as a team)	⊖	⊖	☑	⊖	☑	☑	☑	⊖	☑	☑	⊖	⊖
	Horbar et al. 2004	Unclear	⊖	⊖	☑	⊖	☑	☑	☑	⊖	☑	☑	⊖	⊖
Total			5	3	20	15	14	14	12	15	8	9	2	6

Notes: ^aExtra details on study components are provided in Shafer et al. 2008.

^bDiscrepancy between two articles in the same study.

Key
☑ Yes
⊖ No
⊖ Unclear

TABLE 3
QIC Components Highlighted for Comparison

Study Information	QIC Components	QI Processes	Organizational Involvement
<i>This category highlights the basic study details of the published article.</i>	<i>To which common QIC components did the study authors explicitly refer, according to the definition of QICs compiled from a review of the literature?</i>	<i>Beyond the QIC's basic components, which quality improvement techniques were included?</i>	<i>In theory, QICs enable an organization to enact change at multiple levels within their organizational structure. Did the QIC take steps to train or otherwise involve members of the organization who were not directly included in the collaborative?</i>
Target for Improvement What was the focus of the QIC?	Length of Collaborative Can a standard collaborative length be established?	Sites Collected and New Data for QI During the collaborative, did sites collect new data for quality improvement purposes?	Leadership Involvement/Outreach Did members of the collaborative involve or otherwise reach out to local leadership?
Model(s) Did the QIC align with existing collaborative models?	Pre-Work: Convened Expert Panel The BTS model calls for a planning group that identifies targets for improvement change and plans the collaborative.	Sites Reviewed Data and Used Feedback Did the collaborative sites review new data and adjust their practices according to findings?	Training for "Non-QI Team Staff Members" by Experts Did QIC faculty or other experts provide training for staff members who were not a part of the QI Team?
Study Design Was the study quasi-experimental or a randomized control trial?	Pre-Work: Organizations Required to Demonstrate Commitment The BTS model recommends requiring formal commitments, application criteria, or "readiness" activities for QIC sites.	External Support with Data Synthesis and Feedback Did QIC faculty or other experts provide support with data synthesis and feedback?	Training for "Non-QI Team Staff Members" by the QI Team After the collaborative, did newly trained QI team members provide training for staff members who were not a part of the QI Team?

Continued

TABLE 3—Continued

Study Information	QIC Components	QI Processes	Organizational Involvement
Study Sample What was the population of focus?	In-Person Learning Sessions Teams are traditionally trained in clinical approaches and QI approaches during initial in-person sessions.		
Additional Data Sources Did authors examine data other than the data collected for quality improvement purposes?	PDSAs Plan-Do-Study-Act (PDSA) cycles are a key component of the rapid cycle approach to change recommended by the BTS model.		
Patient Outcomes Did authors report patient-level outcomes? Were the aggregate findings positive, mixed, or negative?	Multidisciplinary QI Team QICs typically involve staff members at various levels of the organization.		
Provider Outcomes Did authors report provider-level outcomes? Were the aggregate findings positive, mixed, or negative?	QI Team Calls Calls among QI team members or members in other participating organizations are common.		
	Email or Web Support Email, listservs, or other forms of web support have become a common approach for providing ongoing support.		

multidisciplinary group, and during the collaborative, the team is expected to share the knowledge gained with the leadership and frontline staff not directly part of the collaborative. Although QI teams may not be charged explicitly with training or educating frontline staff, this can be helpful for achieving QIC improvement goals (e.g., Nembhard 2012; Nembhard and Tucker 2011).

Update on QIC Components and Outcomes from Studies Published since 2006

Of the thirteen new articles published since Schouten and colleagues' 2008 review, eleven were unique studies, and one (McInnes et al. 2007) was a follow-up paper to an article in the Schouten review (Landon et al. 2004). From a methodological perspective, three of the new studies were randomized controlled trials, and the remaining nine were quasi-experimental studies. Eleven articles examined provider-level outcomes, and only four contained information on patient-level outcomes. Finally, one article focused solely on the QIC's cost-effectiveness compared with the costs of usual care (Schouten et al. 2010b).

With respect to QIC structure and components, the more recent collaboratives were shorter in duration than those in Schouten and colleagues' 2008 review, ranging from six to eighteen months, compared with one to three years, and they reported the more frequent use of email or web support. As with the collaboratives reviewed by Schouten, the majority of the recent collaboratives we studied were based on the Breakthrough Series model. Formal pre-collaborative preparation was rarely reported and was described in only five studies (Carlhed et al. 2006; Howard et al. 2007; Polacsek et al. 2009; Schouten et al. 2010a, 2010b).

With respect to outcomes, the newer studies continued to concentrate more heavily on assessing provider-level outcomes and found less evidence for QIC benefits at the patient level. In keeping with the original Schouten review, thirteen papers found significant mixed positive or positive results at the provider level. Of the four new studies examining patient-level outcomes, one found significant positive results (Barceló et al. 2010); two found mixed positive results (Carlhed et al. 2009; Schouten et al. 2010a); and one had null findings (Colón-Emeric et al. 2006).

With respect to study design, three of the more recent studies compared the QIC with another active intervention. In an RCT, Chin and colleagues (2007) compared a standard-intensity and a high-intensity QIC for diabetes care; the high-intensity condition contained a week-long train-the-trainer course for QIC members. Study outcomes did not differ across these conditions (Chin et al. 2007). Another RCT conducted by Kritchevsky and colleagues (2008) compared a standard QIC condition with a “feedback only” condition in which nonintervention sites received two customized feedback reports on five performance measures at baseline and several months later. There were no differences across the conditions, although both groups showed improvements over time on provider-level outcomes. Finally, Carlhed and colleagues (2006) conducted a quasi-experimental study in which the sites in the intervention arm were randomized to receive a standard QIC versus a model that included more web-based interaction, fewer in-person meetings, and less contact with other QI teams. No differences were found between the active conditions, and all analyses were conducted with these groups combined.

Description of QIC Components Reported in Studies

The majority of studies relied on medical chart reviews and hospital administrative data to examine outcomes. Seven studies used phone interviews or surveys with patients (Baker et al. 2005; Homer et al. 2005; Margolis et al. 2008; McInnes et al. 2007; Polacsek et al. 2009; Schouten et al. 2010a, 2010b). Sixteen studies were based on the IHI Breakthrough Series (BTS) model, and eight of them used the IHI BTS model to implement the Chronic Care model as part of a joint effort of the IHI and the Robert Wood Johnson Foundation (RWJF). Three more studies also used the BTS and the Chronic Care model, but not as part of the RWJF program. Two studies were based on the Vermont Oxford Network’s approach, and two studies did not clearly specify the approach used.

We found fourteen crosscutting structural and process-oriented components, including in-person learning sessions, phone meetings, data reporting, feedback, training in QI methods, and use of process improvement methods. On average, each study implemented an average of

six or seven QIC components. The most commonly reported components were in-person learning sessions (twenty out of twenty), PDSAs (fifteen out of twenty), multidisciplinary QI team (fourteen out of twenty), and new data collection as part of the QI process (fifteen out of twenty). However, there was very little detailed information on the ways in which the components were delivered.

Overall QIC Structure. The QICs lasted an average of twelve months (ranging from six to thirty-six months) and typically began with an in-person learning session, attended by the multidisciplinary quality improvement teams (QI teams) and led by QIC expert faculty. We followed up through additional in-person learning sessions, regular phone meetings for the QI teams, and web-based or email support. The sites conducted QI projects between QI team calls and in-person learning sessions. All in-person learning sessions and most phone meetings involved multiple sites.

Multidisciplinary Quality Improvement Teams. Fourteen of the twenty studies reported the presence of multidisciplinary quality improvement teams but did not always specify whether they represented a range of positions within the organization's hierarchy. Studies that did not report the use of a multidisciplinary team may have reported numbers of team members but did not describe the team members' roles within the organization. All the participants may have been either direct care providers or management-level staff.

In-Person Sessions. All the studies reported having in-person learning sessions during the collaborative, typically three (ranging from one to eight). In-person sessions were typically two days long (ranging from one to three). Two studies had QICs with more frequent in-person contact. One, a QIC with eight in-person sessions, was part of an RCT comparing a standard- and high-intensity QIC (Chin et al. 2007). The second, a QIC improving pain management in nursing homes, had six bimonthly in-person meetings that were each two hours long (Baier et al. 2004).

Content of In-Person Learning Sessions. Although seventeen studies provided some information about the content of the learning sessions, the level of detail varied tremendously. All the QICs in these studies included didactic training in a particular care process or practice (e.g., the Chronic Care model, pain management guidelines). They provided training in quality improvement techniques, such as PDSA cycles. The articles contained very little detail about the structure or process of the training or which techniques were taught during the training. In

eleven of the studies, the QIC purveyors had already identified areas for improvements that sites could target in QI projects (e.g., domains in the chronic care model, use of specific tools, system improvements, known implementation barriers) (Asch et al. 2005; Baker et al. 2005; Barceló et al. 2010; Benedetti et al. 2004; Carlhed et al. 2006, 2009; Chin et al. 2007; Howard et al. 2007; Landon et al. 2007; Polascek et al. 2009; Schouten et al. 2010a, 2010b). Two studies indicated that a review of the baseline data was incorporated into the collaborative, and only two studies described the training for collecting data for QI (Polascek et al. 2009; Schouten et al. 2008).

In addition to didactic training, eight studies reported that in-person sessions were used to foster team planning and cross-site sharing of experiences. Again, the articles included few details on the structure of this collaboration. Landon and colleagues (2007) reported individual site presentations, breakout sessions, and the use of “storyboards.”

PDSAs. Fifteen studies reported using PDSAs during the learning collaboratives but offered very little information about the specific QI processes. The articles that did provide some detail typically described a “model for improvement” or PDSA cycles conducted between in-person sessions or phone calls. The studies rarely described specifically the sites’ experiences during PDSA cycles, how PDSAs were integrated into improvement efforts, or how ongoing data collection informed the QI process.

QI Team Calls. Fourteen studies reported cross-site calls for the QI teams between in-person sessions. According to those studies that reported call frequency, calls were conducted biweekly, monthly, or quarterly, with monthly the most common. No information was provided about call content or structure. Interestingly, in one study, instead of calls, the QI teams had six bimonthly, two-hour in-person meetings (Baier et al. 2004). In these meetings, the teams used “audit and feedback,” a systematic quality-improvement approach focusing on PDSA cycles, and one-on-one mentoring from nurses experienced in QI (Baier et al. 2004).

Email or Web Support. Twelve studies reported web-based or email support for the QIC participants, but they did not provide any information about the extent to which QIC participants used this support.

Quality Improvement Processes. In general, the studies provided very little information about the type of data collected, how they were used, or how they informed quality improvement activities. Fifteen studies

TABLE 4
Summary of Outcomes across QIC Studies

Reported Findings	Patient-Level Outcomes (no. of studies)	Provider-Level Outcomes (no. of studies)
Positive findings	3	9
Mixed findings	6	8
Null findings	4	2
Not applicable / Not assessed	11	5

reported some kind of ongoing data collection for the QIC (e.g., performance indicators, ongoing reporting on target outcomes). Eight studies reported that the QIC faculty gave the sites feedback, and nine studies reported external support for data synthesis and feedback.

Organizational Involvement. Nine studies reported that the organization’s leadership was involved in the QIC, but it was unclear whether the organizational leadership was included on the QI team or was engaged through other means. We also examined indicators of the QIC’s penetration into the broader organization by tracking any training of non-QI team members, by either QIC expert faculty or local QI team members themselves. Two studies reported training from both QIC faculty and QI team members for frontline staff members not already on the QI team. Only four other studies, however, reported that the QI team members trained additional staff in the organization.

Pre-QIC Activities. Finally, we tracked “pre-work” activities, defined as planning activities delineated by the QIC model (IHI 2003; Kilo 1998). Five studies reported that the QIC used an “expert panel,” a group that finds targets for improvement and plans the collaborative. Note that many IHI BTS collaboratives employed expert panels before launching a QIC and therefore may not have been reported. Only three studies reported requiring formal commitments, application criteria, or “readiness” activities for QIC.

Relation between QIC Components and Study Outcomes

As table 4 shows, eight studies that assessed provider outcomes reported mixed positive outcomes, and nine reported significant positive outcomes. Of the thirteen studies that examined patient-level outcomes,

six reported mixed positive outcomes, and three reported significant positive outcomes. There did not appear to be a clear pattern of findings by the type of QIC model cited by the study. In addition, two studies looked at cost, with Rogowski and colleagues (2001) finding lower neonatal treatment costs for sites participating in the QIC, and Schouten and colleagues (2010b) concluding that sites that participated in the QIC demonstrated a favorable incremental cost-benefit ratio compared with those that did not. Of note, the vast majority of studies relied on administrative data or medical record abstracts to assess process of care, provider-level, and patient-level outcomes. Although some studies did include patient surveys, none directly assessed provider behavior.

Given the inconsistency in reporting on the QIC components used in each collaborative and the lack of detail regarding the extent to which each component was actually used, we could not determine whether particular components of the QIC were more or less predictive of observed study outcomes. While the studies often referred to a particular QIC approach (e.g., IHI BTS, Vermont Oxford Network), most did not specify which components they used, how intensively those components were implemented, or whether the collaborative was conducted with fidelity to the original model. With the exception of a few studies (Landon et al. 2007; Polascek et al. 2009; Schouten et al. 2010a), quality improvement processes were not described in detail, and the use of data and feedback was given little space. In addition, with the exception of data on providers' attendance at QIC activities, providers' engagement in the QIC components was not investigated.

Discussion

QICs hold promise for increasing sustained change by building local capacity and for addressing organization- and provider-level implementation barriers that have been identified in the literature but are largely ignored by traditional consultation approaches to the intervention developer (Bero et al. 1998; Feldstein and Glasgow 2008; Nembhard 2009). QICs may also address implementation barriers by fostering local ownership of the implementation process, creating a culture of continuous learning, training organizations in QI processes that can be used to identify and target implementation barriers, promoting transparency

and accountability, providing an infrastructure for addressing common barriers (provider concerns, leadership support, logistics, structural challenges), and creating an interorganizational support network from which sites can learn from others' successes and challenges.

The number of controlled studies of QICs has grown quickly in the past several years. The majority focused on QICs for chronic medical conditions, as well as a broad range of targets (ranging from management of chronic conditions and pain to fall reduction, health disparities, neonatal intensive care, and medication-related practices in adults). In contrast, no controlled studies in behavioral health have been published, even though it is an area where QICs have begun to proliferate (e.g., Ebert et al. 2012; SAMHSA Bulletin 2012). More randomized studies are needed to test the effects of collaboratives on the process of care and provider-level and patient-level outcomes. Of the twenty studies we reviewed, only five were RCTs, and only three compared the QIC with another active condition.

Nonetheless, the studies we added to Schouten and colleagues' 2008 work provide further evidence that QICs can effect change at the provider level, particularly the process of care variables (e.g., medication management, patient education, tracking of preventive actions). The studies comparing QICs with other active conditions appeared less likely to find differences across groups (Carlhed et al. 2006; Chin et al. 2007; Kritchevsky et al. 2008). However, we should note that each of these had its own comparator conditions, so their findings must be interpreted in context. Consistent with Schouten and colleagues' 2008 review, the additional studies in this review reveal that patient-level variables were assessed less often and the findings were decidedly more mixed than those for provider and process of care variables. The reason may be most studies' limited time frames, which may not have been long enough to observe any changes in patient outcomes. Our review also looked at a study on cost, finding favorable incremental cost-benefits in a collaborative on diabetes care (Schouten et al. 2010b).

Despite some studies' positive findings for provider outcomes, it is important to note that the outcome measures were largely derived from medical records or administrative data and did not directly assess changes in provider behavior. Similarly, at the patient level, few studies directly assessed patient outcomes (e.g., Baier et al. 2004; Baker et al. 2005; Barceló et al. 2010; Benedetti et al. 2004; Carlhed et al. 2009; Horbar et al. 2001; Mangione-Smith et al. 2005; Schonlau et al.

2005; Schouten et al. 2010a). Future studies, therefore, should collect more primary data on patient- and provider-level outcomes in order to determine whether procedural improvements translate into better patient care. In addition, economic analyses and longer-term studies should look at whether improved health care outcomes, use of skills gained in the QICs (e.g., QI methods), and cost savings can be sustained over time.

A major goal of our study was to find out how QIC components are described in the empirical literature and to explore potential relations between components and outcomes. Across the studies, QICs had a similar overall structure (Horbar et al. 2001; IHI 2003; Kilo 1998; Lesar et al. 2007; Rogowski et al. 2001), but except for a few recent studies (e.g., Landon et al. 2007; Polacsek et al. 2009; Schouten et al. 2010a), not enough details about the presence or implementation of QIC components were provided. In addition, very few studies made a comparison that would allow insight into QICs' critical features. Thus, active QIC features (i.e., having an agency director as a team member, dosage of the components, provider engagement in the QIC, interagency communication) were impossible to determine or link to specific outcomes. As QICs continue to grow in popularity, this lack of detailed information makes it impossible to replicate successful QICs, to ensure that adaptations of QICs include key active ingredients, or to determine whether negative outcomes are related to the quality and fidelity of delivering this multicomponent improvement model or differential efficacy of QICs for different EBPs.

Given the roots of the QICs in the work of management theorists such as Deming and Juran (Deming 1986; Juran 1951, 1964), the lack of specific detail about QI processes is noteworthy. Although fourteen studies reported collecting data for QI and implementing QI processes like PDSA cycles, with a few noteworthy exceptions (e.g., Landon et al. 2007; Schouten et al. 2010a), we have little specific information about how local data were used to inform QI. Because previous studies indicated that QIC participants perceive instruction in QI methods to be useful (e.g., Meredith et al. 2006; Nembhard 2009; Shortell et al. 2004), it would be helpful to have specific details about how the data were collected and used to inform QI projects and assess change. In some cases, QI projects appeared to have been undertaken based on qualitative reports and already identified QI targets, and not data (Asch et al. 2005; Horbar et al. 2001). Part of the reason may be no directly applicable data for some of the targeted practices, or no cultural shift toward the

use of data and continuous quality improvement in health care. In either case, information about the key drivers of quality improvement is sorely needed.

Limitations

Limitations inherent in the systematic review process should be considered when interpreting these findings. As with any review, relevant studies may have been omitted. By searching multiple databases, reviewing the reference lists of key articles, and cross-checking with free-text search terms, we minimized the possibility of such omissions. In addition, we confined our review to studies that included control groups and may not have included all large-scale implementation models that might be similar, in some ways, to the QICs we examined. Given the few details provided by many of these controlled studies, some studies without control groups may provide additional useful information about key aspects of QICs (e.g., Dückers et al. 2009; Nembhard 2009, 2012).

Future Directions

To advance our understanding of the effectiveness of QICs, future studies need more detailed information about at least six core elements: the dosage of individual QIC components; teaching strategies and approaches to fostering cross-site collaboration; use of data to guide QI processes; fidelity to the QIC model; degree of engagement among participating sites; and sustainability of QI activities. To date, there are very few detailed, published manuals on the elements of QICs or evidence-based descriptions of the most effective ways to conduct a collaborative (e.g., Markiewicz et al. 2006). Future research also should investigate the competence and skill of the QIC faculty and the quality of implementation of QIC components. More study of QICs is needed in other aspects of health care as well, notably behavioral health, especially given the investments by federal and state entities in QICs as a vehicle to disseminate evidence-based practices. Careful study of ongoing efforts to assess QICs' feasibility and utility for disseminating often more highly complex behavioral health interventions is much needed.

Recent studies exploring aspects of QICs that participants found useful offer helpful insights into QIC components that could be directly

tested in future studies. For instance, Nembhard (2009) found six QIC features that participants in an IHI BTS model collaborative found most helpful (expert faculty, the sharing of ideas and experiences, the change package, PDSAs, interactions during in-person sessions, and the collaborative Internet). The participants found that interorganizational learning and the use of local deliberate learning activities (e.g., staff education, PDSAs) were likely to be important to outcomes (Meredith et al. 2006; Nembhard 2012; Nembhard and Tucker 2011). Other researchers have suggested that local leadership support, sites' ability to address common implementation barriers, expert support, ongoing data collection, and the visibility of local changes achieved through QI methods may help achieve change (Ayers et al. 2005; Brandrud et al. 2011; Dückers et al. 2009; Pinto et al. 2011). A related focus for future research is the development of methods that can be used to understand QICs' features and the results of studies in various contexts and intervention targets. For example, measures like the one developed by Schouten, Grol, and Hulscher (2010) that assess QICs' core features could be fielded and refined. Similarly, measures that assess an organization's implementation progress and process, such as the Stages of Implementation Completion, could be further studied (Chamberlain, Brown, and Saldana 2011). Recent research also has highlighted the importance of documenting and reporting sufficient detail about the study context in RCTs of complex interventions (Wells et al. 2012). Such information is critical to understanding the transferability of complex interventions as well as issues related to internal and external validity (Wells et al. 2012).

Once the active ingredients of QICs are identified, health care researchers will be able to develop and test theories of change. Using a social-ecological framework, QIC and similar interventions will probably be able to operate at multiple levels in the system (i.e., intrapersonal, interpersonal, organizational, community, and macropolicy) (Weiner et al. 2012). QIC participants have noted, for example, that at the intrapersonal and interpersonal levels, QICs provide skills, motivation, and social support (Nembhard 2009). These findings are consistent with research suggesting the importance of social networks to large-scale, multisite implementation efforts (Palinkas et al. 2011). Organizationally, QICs could lead to better data infrastructure and less service fragmentation. Causal modeling strategies that account for the complementary and synergistic effects in multilevel interventions would help move the field forward (Weiner et al. 2012).

In summary, the empirical literature on QICs has grown in recent years and shows promise for improving some aspects of clinical care, particularly those related to quality indicators and provider variables. Given the widespread use of QICs as an implementation strategy, however, the existing research literature provides only limited support for the overall effectiveness of QICs in improving patient outcomes and provides little insight into which QIC attributes are most likely to produce the desired change. To maximize the effectiveness and practical relevance of these models as a change strategy, understanding the specific features that drive change is a necessary next step.

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